SEVERANCE CORNERS

TRANSPORTATION IMPROVEMENT PLAN

Prepared for:

Chittenden County Metropolitan Planning Organization and the Town of Colchester

10 October 2007

Chittenden County Metropolitan Planning Organization

Submitted by:
Resource Systems Group, Inc.

SEVERANCE CORNERS TRANSPORTATION PLAN

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1.0 INTRODUCTION

The Severance Corners Transportation Improvement Plan evaluates traffic operations, improvement options, cost estimates, and phased implementation plans at the Severance Corners intersection in Colchester, Vermont. Severance Corners is defined by the area surrounding the intersection of US 2/7 with Blakely and Severance Roads.

The Town of Colchester desires to maintain safe and efficient vehicle flow while accommodating the increasing presence of bicyclists and pedestrians as the Severance Corners Growth Center develops. The area is slated for Vermont growth center designation which will allow the area around the intersection to become the primary destination for development accommodating the majority of the Town's growth for the next twenty years.

Roadway improvements at the Severance Corners intersection will become necessary to meet future traffic demand and provide safe and efficient transportation operations.

The Improvement Plan is divided into the following tasks and objectives:

- Summarize existing and future traffic conditions;
- Develop phasing of intersection improvement options; and
- Prepare cost estimates.

This report summarizes the analysis and findings of each project task.

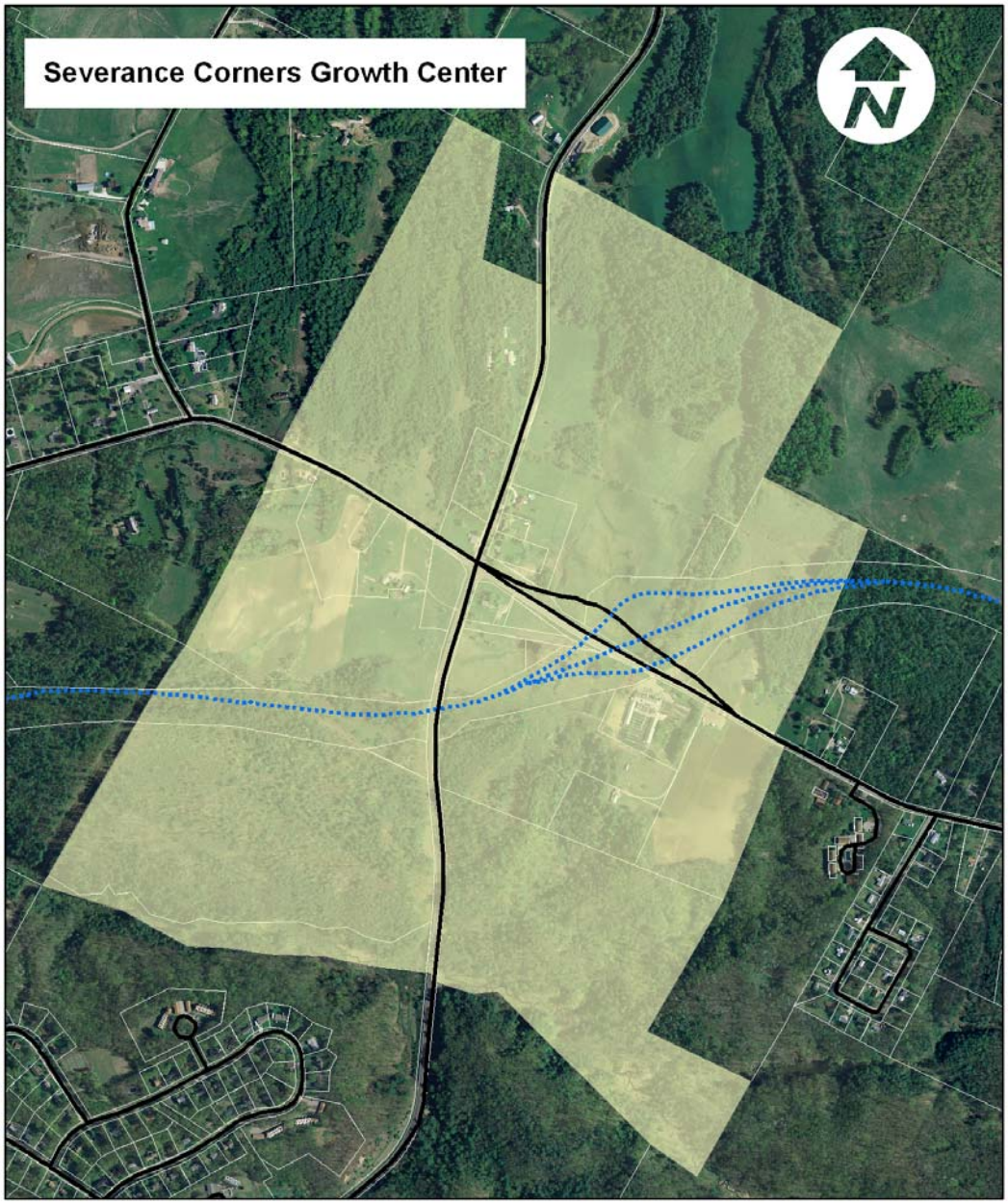
2.0 STUDY AREA OVERVIEW

Severance Corners is located at the intersection of US 2/7 and Blakely and Severance Roads. The US 2/7 corridor is an extremely important north/south link paralleling the I-89 Interstate. Blakely Road serves as an important east/west connection that provides access to the Town's schools and many town services. Severance Road connects to a large employment and retail area in the Town of Essex to the east.

The Severance Corners Growth Center is beginning to take shape and develop. One of the four major quadrants is in mid-build-out (southwest). It is anticipated that the area will be a balance of residential and commercial development. The Town plans to remain flexible and allow transfer of development rights to allow for increased densities.

Figure 1 shows the study area and the outline of the Growth Center boundaries.

Figure 1: Study Area



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3.0 TRANSPORTATION SYSTEM CHARACTERISTICS

3.1 HIGHWAY SYSTEM CONTEXT

The roadways in the study area are components of a connected local, state, and national highway network. Highway functional class, the National Highway System, the Vermont Truck Network and town highway classification are the foundation for a variety of policies that affect funding eligibility, project prioritization, design requirements, jurisdiction, and maintenance and operation responsibilities for a highway. These various classification systems also provide a big picture view that defines the function of a specific, local highway project within the context of the regional, state, and national transportation systems.

3.1.1 Functional Class

Figure 2 shows the functional classification for the study roadways. US 2/7 is classified as an urban principal arterial. Blakely Road is classified as an urban minor arterial and Severance Road is classified as an urban collector.

Mobility for through traffic is the primary function of principal and minor arterials. Though the study area may be regarded as rural, the Severance Corners area operates as an urban corridor with significant vehicle volumes and commuter peak patterns.

Functional classification is used to determine funding eligibility and to establish roadway design standards. In designated urban areas, all collectors, arterials, and freeways are part of the federal aid system and are therefore eligible to receive federal transportation funds.

Table 1 summarizes the major roadway design guidelines as published in the *Vermont State Standards*[1] for principal and minor arterials in urban and rural areas. The guidelines for principal and minor arterials in urban and village areas are identical. The *Vermont State Standards* provide a significant amount of flexibility in selecting lane and shoulder widths for arterials that pass through built-up urban and village areas. The V*ermont Pedestrian and Bicycle Facility Planning and Design Manual* states that 3-foot wide shoulders are sufficient for bicycle travel. However, in accordance with the regional goals of having an on-road bicycle network, 4 foot wide shoulders should be considered as the preferred width along the study highways.

These standards suggest 11 foot wide travel lanes and 4 foot wide paved shoulders are appropriate for the Severance Corners area.

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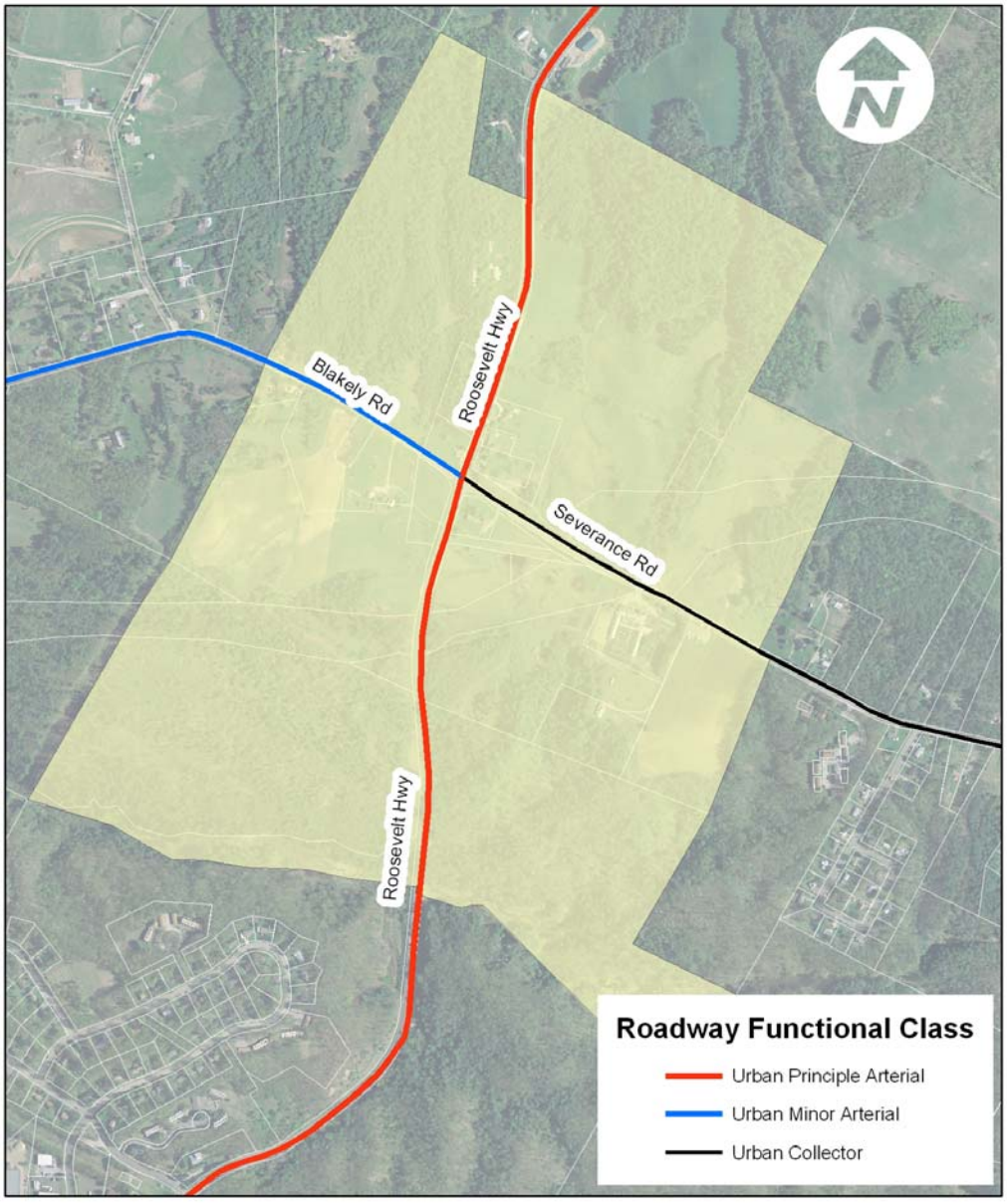
[1] "*Vermont State Standards* for the Design of Transportation Construction and Rehabilitation n on Freeways, Roads and Streets"; State of Vermont, Agency of Transportation; October 22, 1997.

Table 1: Roadway Design Standards

Design Feature	Urban/Village Principal and Minor Arterials	Urban Collector
Design Speeds	30-55 mph, occasionally 25 mph	25-50 mph
Lane Widths	10-12 feet	9 - 11 feet 11 ft generally used on high-speed free flowing
Shoulder Widths	Varies from 2 to 8 ft depending on surrounding area	2 ft minimum
Minimum Shoulder Widths to Accommodate Bicycle Travel	With curbs: 3-6 ft based on speeds from 25-55 mph	3 ft < 50 mph; 4 ft at 50 mph; 5 ft at higher speeds or steep up-grades

Source: *Vermont State Standards*

Figure 2: Road Functional Class



3.1.2 National Highway System (NHS) and VT Truck Route

The NHS consists of Interstate and Defense Highways and principal arterial roads essential for interstate and regional commerce, travel, national defense, intermodal transfer facilities, international commerce, and border crossings. NHS routes were designated in the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA). In the study area I-89 is the only roadway segment that is part of the NHS.

Title 23 V.S.A. Section 1432 as amended by the 2000 Vermont Legislature, establishes the Vermont Truck Network where trucks with overall lengths less than 72 feet (including 53-foot tractor-trailer combinations) may travel without permits. The Truck Network is defined as all of the NHS routes, plus VT 22A between its intersections with US 7 and US 4, VT 105 in its entirety, and VT 104 from I-89 Exit 19 to VT 105. The roads that are not part of the NHS were added to the truck network based on the volume of truck traffic and/or through the legislative decision making process.

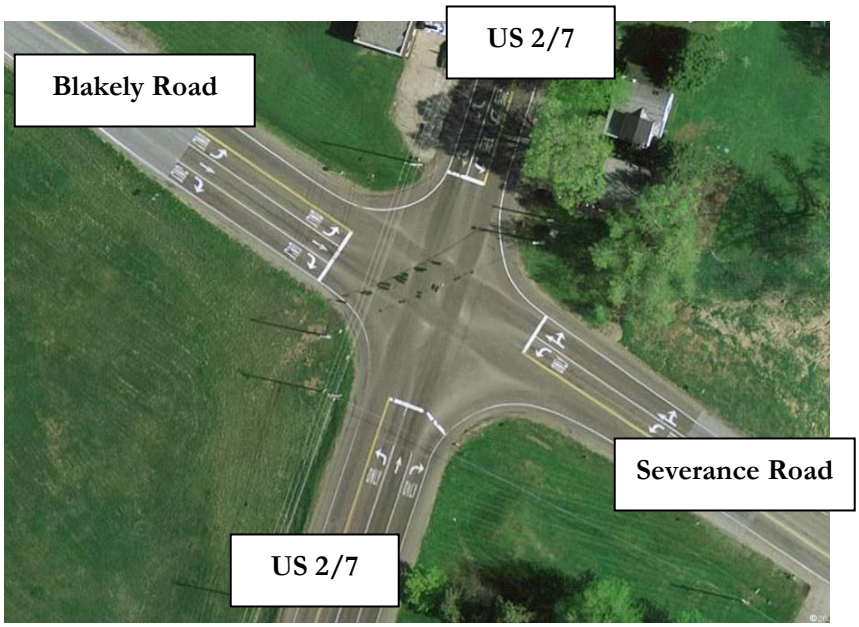
Within the study area, US 2/7 is designated as part of the Vermont Truck Network. Because of this designation, recommendations related to the re-design of Severance Corners should accommodate trucks with overall lengths of 72 feet. This requirement will affect the turning radii at the study intersection and placement of stop bars.

3.1.3 Roadway Jurisdiction

The entire public highway network in Vermont is owned either by the state or a municipality. VTrans has established a roadway classification system to identify the levels of jurisdiction over each section of road across the state. These classifications identify whether, for example, VTrans or the Town is responsible for pot hole patching on a particular section of road. Roads owned by municipalities are categorized as class 1, 2, 3, or 4 town highways. A class 1 town highway has a VT or US route number and is an important part of the state system. In general, municipalities own and are responsible for all maintenance and construction costs associated with class 1-4 town highways although some funds are provided by the state to support projects on local roads.

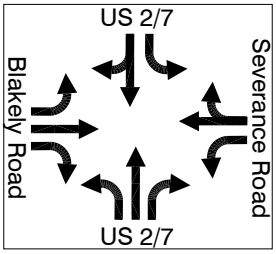
US 2/7 within the study area is owned and maintained by the State of Vermont. Both Blakely and Severance Roads are class 2 town highways. Because US 2/7 is owned and maintained by the State of Vermont it is critical to have the involvement and support of VTrans when deciding what improvement options may be warranted.

Table 2: Study Intersection



The Severance Corners intersection currently exists as an isolated signalized intersection of three significant highways within the Town of Colchester. Currently, the traffic signal has no pedestrian amenities such as crosswalks or pedestrian signals. The lane geometries of each approach are shown below.

Severance Corners
Existing Conditions



The posted speed limit along Severance and Blakely Roads is 35 mph. The speed limit along US 2/7 is set at 50 mph. This plan assumes that when the growth center develops the speed limit along US 2/7 be lowered to 35 mph within the study area. The slower speed limit reinforces and supports the pedestrian friendly nature of the Growth Center.

3.2 PEDESTRIAN AND BICYCLE FACILITIES

There are no existing sidewalks within the study area along any of the study roadways.

US 2/7 has between 4 and 7 foot wide shoulders south of Severance Corners and 2 foot wide shoulders north of the intersection. Blakely and Severance Roads have 3 and 4 foot wide shoulders, respectively.

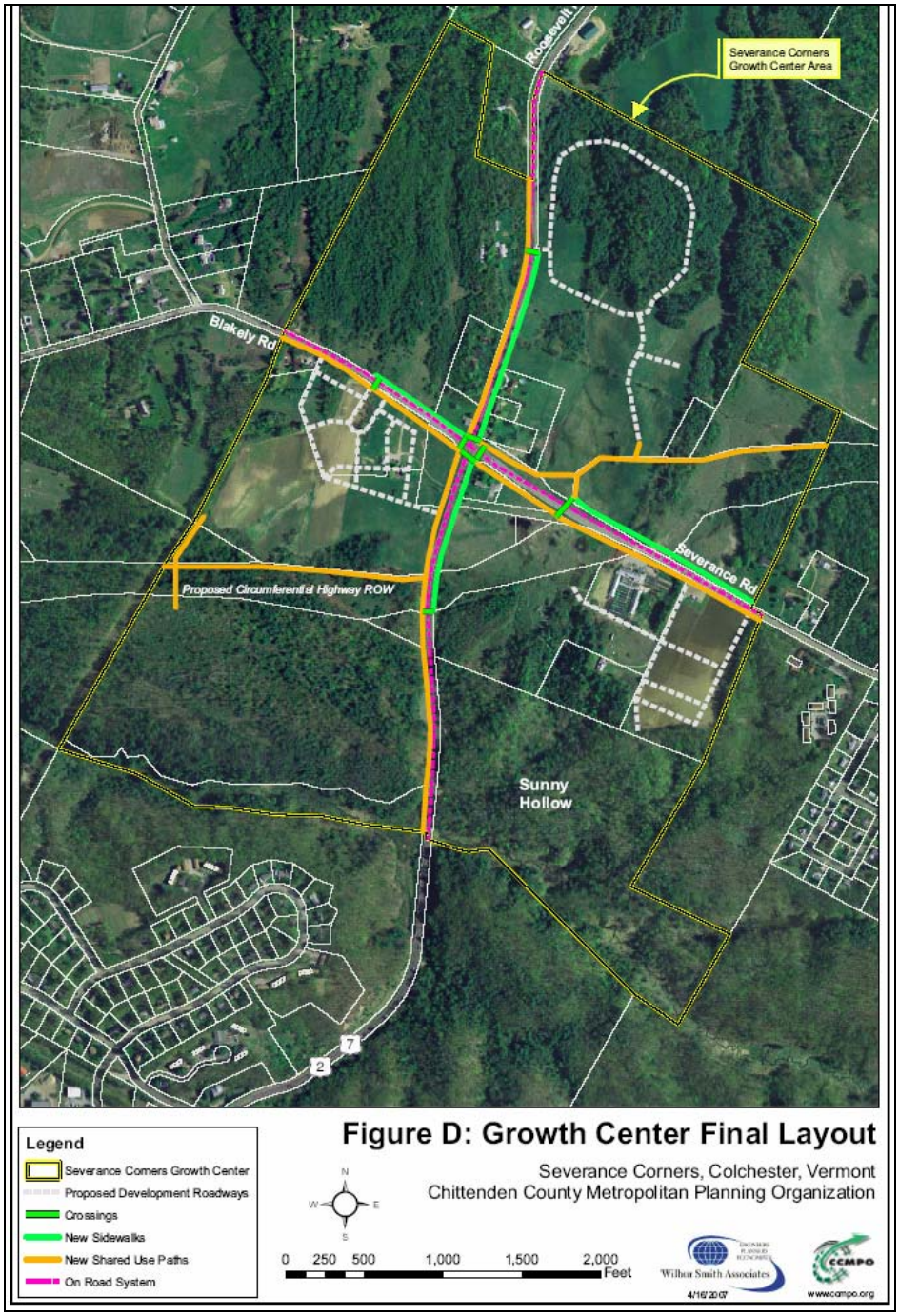
The Town of Colchester with assistance from the Chittenden County Metropolitan Planning Organization has completed a study to determine the scope and location of pedestrian and bicycle facilities within the Severance Corner growth center. The study developed an overall masterplan for sidewalks, shared use paths, crosswalks, and on-road bicycle facilities.

Figure 3 shows the approximate locations of the pedestrian and bicycle facilities that the study recommended. In summary:

- Sidewalks would be placed within the right-of-way along US 2/7 on the east side of the highway;
- Shared-use paths would be placed within the right-of-way along the south side of Blakely Road, west side of US 2/7, and the south side of Severance Road;
- The north side of Severance Road will include a section of sidewalk and a segment of a shared-use path within the road right-of-way;
- Crosswalks would be placed along each approach at Severance Corners; and
- Unsignalized marked pedestrian crossings would be placed across Blakely and Severance Roads and US 2/7 approximately 1,000 feet away from the intersection on each approach.

The actual implementation of the bicycle and pedestrian plan may be stretched out over many years and be tied to full build out of the Severance Corners area. Elements such as unsignalized marked crossings along State owned and maintained highways need to meet warrants showing sufficient demand before installing, while other elements such as the shared-use path can be implemented concurrently with the adjacent development.

Figure 3: Growth Center Pedestrian and Bicycle Facilities (CCMPO Study)



4.0 TRAVEL DEMAND

This section describes the development of existing 2007 and future 2017 year traffic volumes during the AM and PM peak hours used to develop and evaluate intersection improvement options.

4.1 DEVELOPMENT OF 2007 AM AND PM PEAK HOUR DHV VOLUMES

The turning movement count for the study intersection was conducted on Tuesday, 20 June 2006. The AM peak hour occurred at 7:30 – 8:30 AM and the PM peak hour occurred at 4:45 – 5:45 PM.

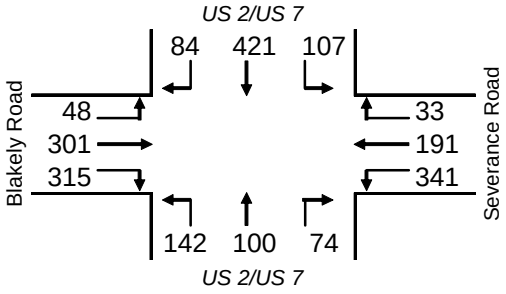
The raw traffic counts have been modified to represent the design hour volume (DHV)[1] in 2007 using two adjustment factors:

- The design hour adjustment factor is based on VTrans Continuous Traffic Counter (CTC) D040, located on US 2/7 in Colchester south of the study intersection. This counter collects traffic volumes 365 days per year, 24 hours per day. These data describe the daily fluctuations in traffic volumes and are used to adjust a ground count conducted on a specific date to the design hour. The counts conducted on 6/20/2006 were increased by 10.1% to reflect design hour conditions. The adjustment was based on the 2006 DHV of 1,706 vehicles per hour.[2]
- An annual adjustment factor, which represents general background traffic growth, is based on the growth rate for Urban Highways taken from the 2005 VTrans Red Book. The adjustment factor grows the traffic volumes from the 2006 count date to the 2007 base analysis year. The adjustment factor increases the volumes by 0.5%.

Figure 4 and Figure 5 presents the 2007 design hour volumes for the AM and PM peak hour.

Raw turning movement count data and adjustments are provided in Appendix A.

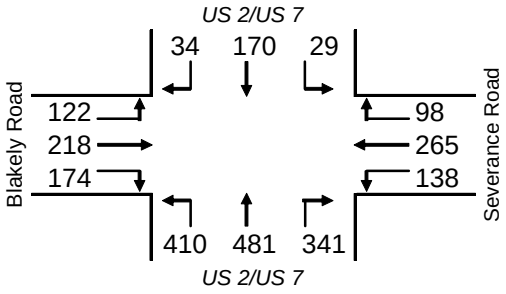
Figure 4: 2007 AM Peak Hour Volumes



[1] The DHV is the 30th highest hour of traffic for the year and is used as the design standard in Vermont.

[2] 2006 DHV was obtained from the VTrans Traffic Research Division.

Figure 5: 2007 PM Peak Hour Volumes



4.2 FUTURE 2017 TRAFFIC

The future traffic demand in 2017 includes growth in the background traffic volume plus the traffic generated from the anticipated development in the Severance Corners area.

4.2.1 Development of Background 2017 Volumes

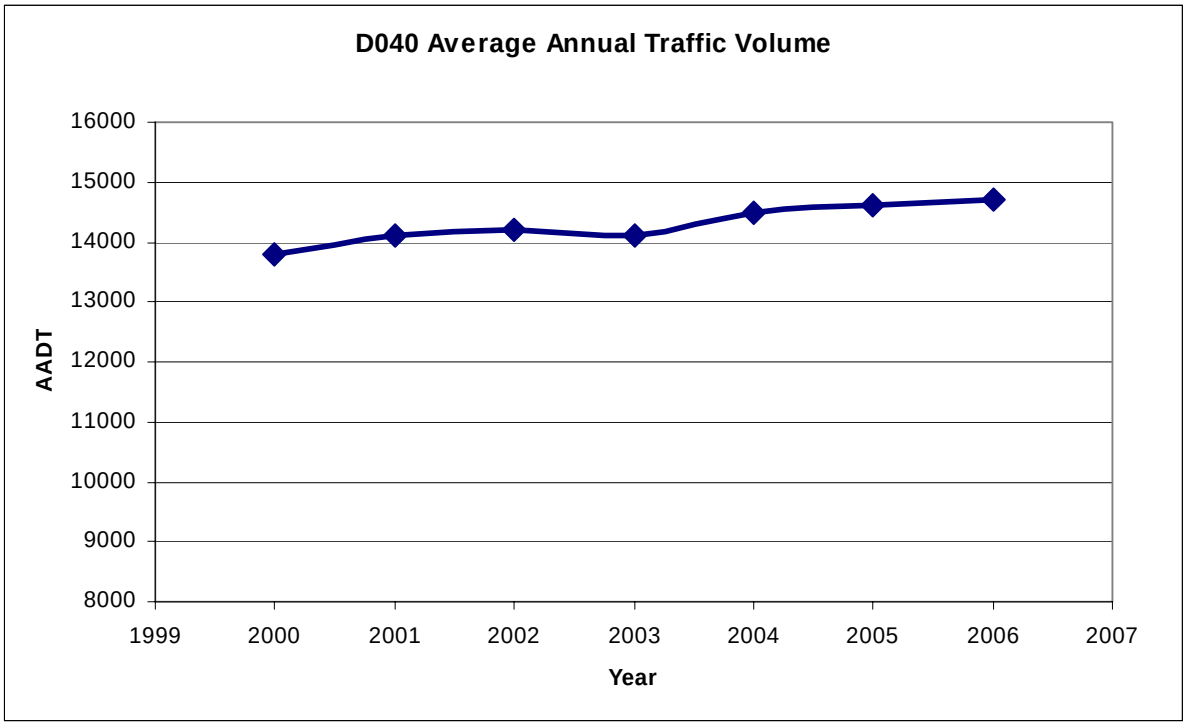
The base 2007 traffic volumes were grown to represent future 2017 traffic volumes. The annual growth estimates used were based on recent past data at the D040 CTC along US 2/7. The background growth rate used when estimating future 2017 conditions is an important assumption, as it can influence the final outcome for intersection improvements. RSG has analyzed the intersection under different growth assumptions using 0.5%, 1.0%, and 1.5% annual background growth rates.

The following items were considered in selecting an appropriate background growth rate:

- **Long-term traffic growth at the CTC:** The Vermont Agency of Transportation publishes their annual 'Red Book' that includes traffic data history and projections for the State's transportation system. The 2005 Red Book states that the 20 year growth factor for the D040 CTC is 1.37. This growth factor results in an annual growth rate of 1.59%.
- **Population forecasts of the Town of Colchester:** The 2007 draft of the Town Master Plan estimates that if population growth remains similar to that as seen during the 1990's, the population will grow at a rate of 1.24% annually.[1] Without investigating the demographics of the Town further we could roughly assume that a 1.24% annual population growth would translate to an equal annual growth in traffic volume.
- **Recent traffic volume trend at the D040 CTC:** The recent (2000 – 2006) traffic volume trend at the CTC shows a slower growth rate relative to the longer-term trends, at approximately 0.95% annually. The recent average annual traffic volumes are shown in Figure 6.

[1] Town of Colchester Master Plan, Draft (2/6/2007) Community Section. Pg. 6.

Figure 6: CTC D040 Average Annual Daily Traffic Growth: Recent Trend (2000-2006)



A 1.0% annual growth rate is appropriate based on recent volume trends at the D040 CTC location. The two other higher growth rates are inappropriate for the following reasons:

- The long-term trend of the CTC (Figure 7) reflects a bias in the calculation from significant traffic volume growth in the late 1980's and early 1990's that could be attributed to the large amount of development that occurred off of Water Tower Hill and Lower Mountain View Drive near I-89 Exit 16.
- The population growth figure seems like a reasonable estimate. However, the traffic from specified development projects around Severance Corners is already considered in the population growth forecast. Therefore using the population growth rate would result in double counting the traffic growth (since the Growth Center by definition is to accommodate the majority of growth over the next 20 years) associated with the development around Severance Corners.

The 1% annual growth rate was used to develop the 2017 base background volumes shown in Figure 8 and Figure 9.

Figure 7: CTC D040 Average Annual Daily Traffic Growth: Long-Term Trend

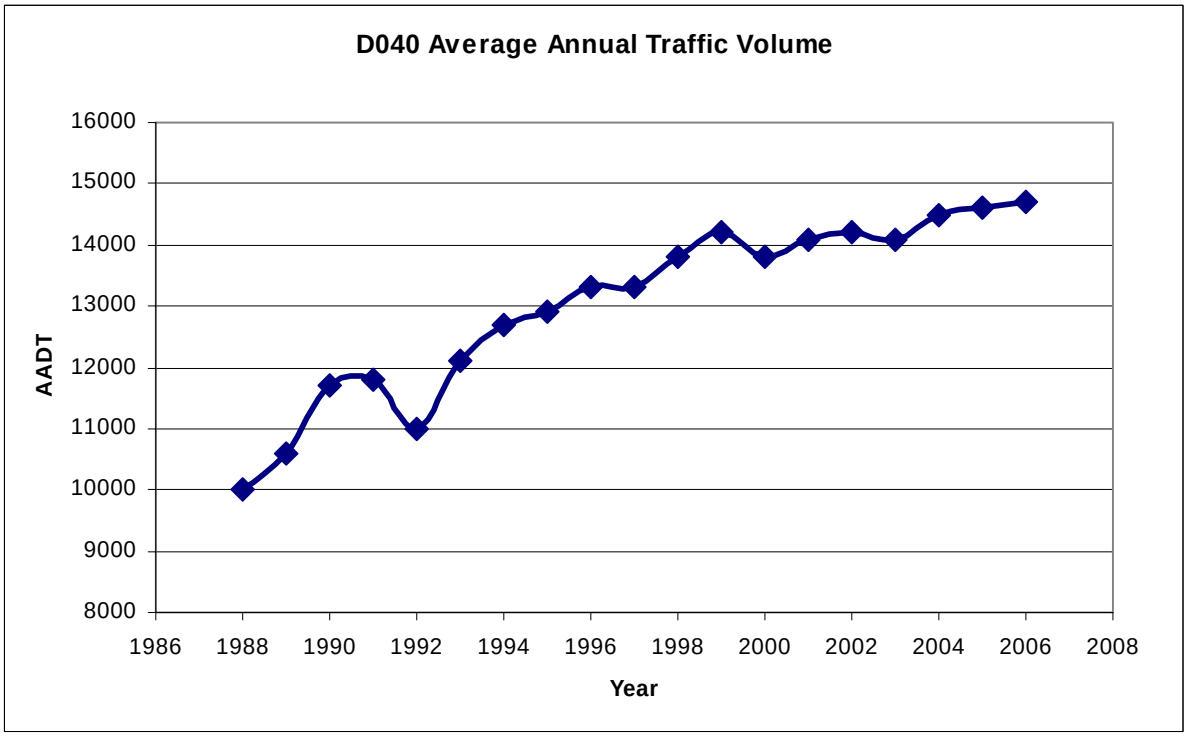


Figure 8: 2017 AM Peak Hour Volumes (Background Growth)

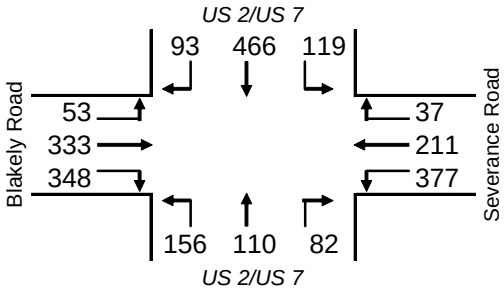
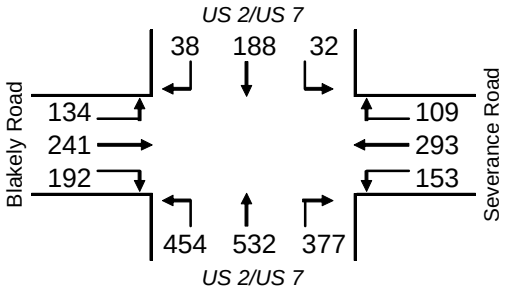


Figure 9: 2017 PM Peak Hour Volumes (Background Growth)



4.2.2 Severance Corners Development Traffic Growth

Existing traffic studies were used to estimate the amount of development and traffic generation for 3 of the 5 specific large developments assumed within the growth center. For the remaining two developments, RSG estimated the amount of traffic generated by the developments based on input from the Town of Colchester on the size and nature of their potential land uses. The locations of the five developments are shown in Figure 12.

The five significant developments in the Severance Corners area are highlighted in Table 3.

Table 3: Severance Corner Developments

		Land Use		Trip Generation	
Description	**Location**	**Size and Type**	**Source**	**Amount (vehicle trips)**	**Source**
Ireland Industries - Severance Corners Village	Southwest Quadrant	150 Residential Units 80,000 square feet of commercial space	TIS	AM: 214 PM: 343	Study TIS
Robenstien, Colleen, and Warren - Retirement Community	Southwest Quadrant	80 unit retirement community	Town	AM: 68 PM: 58	Study
Ireland Industries	Southeast Quadrant	206 Residential Units 54,540 square feet of commercial space	TIS	AM: 228 PM: 132	TIS
Frisbee Development	Northeast Quadrant	113 Residential Units	TIS	AM: 83 PM: 104	TIS
Ireland Industries	Northwest Quadrant	180 Residential Units	Town	AM: 83 PM: 97	Study
Wells Property	Northeast Quadrant	13 Residential Units 20,000 square feet of general office space	Town	AM: 39 PM: 39	Study

The project development traffic was assigned through the study intersection as shown in the traffic impact studies, where available, or in proportion to existing traffic volumes. The project traffic through the Severance Corners intersection are shown in Figure 10 and Figure 11.

Figure 10: Total AM Severance Corners Development Traffic

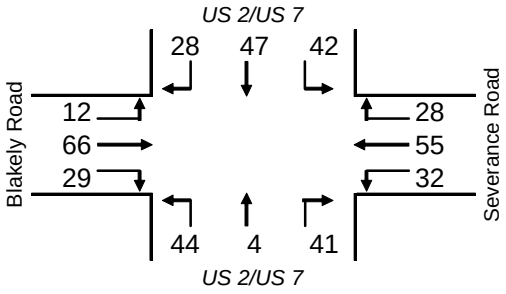


Figure 11: Total PM Severance Corners Development Traffic

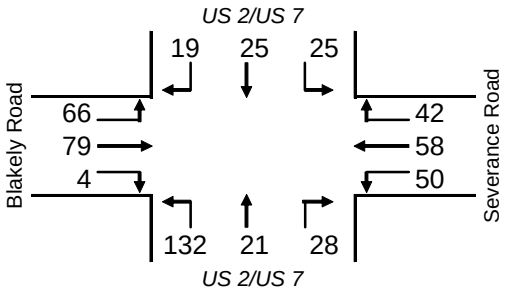


Table 4 shows the percentage of total Severance Corner area traffic through the study intersection that is attributed to each development.

Table 4: Growth Center Development - Traffic Breakdown

Development	PM Peak Hour Trips through Severance Corners	Percent of Total
Ireland (SW Quad)	223	41%
Ireland (SE Quad)	152	28%
Frisbee Development (NE Quad)	61	11%
Ireland (NW Quad)	53	10%
Robenstien, Colleen and Warren (SW Quad)	40	7%
Wells Property (NE Quad)	19	3%
Total Growth Center	548	100%

Figure 12: Significant Growth Center Parcels

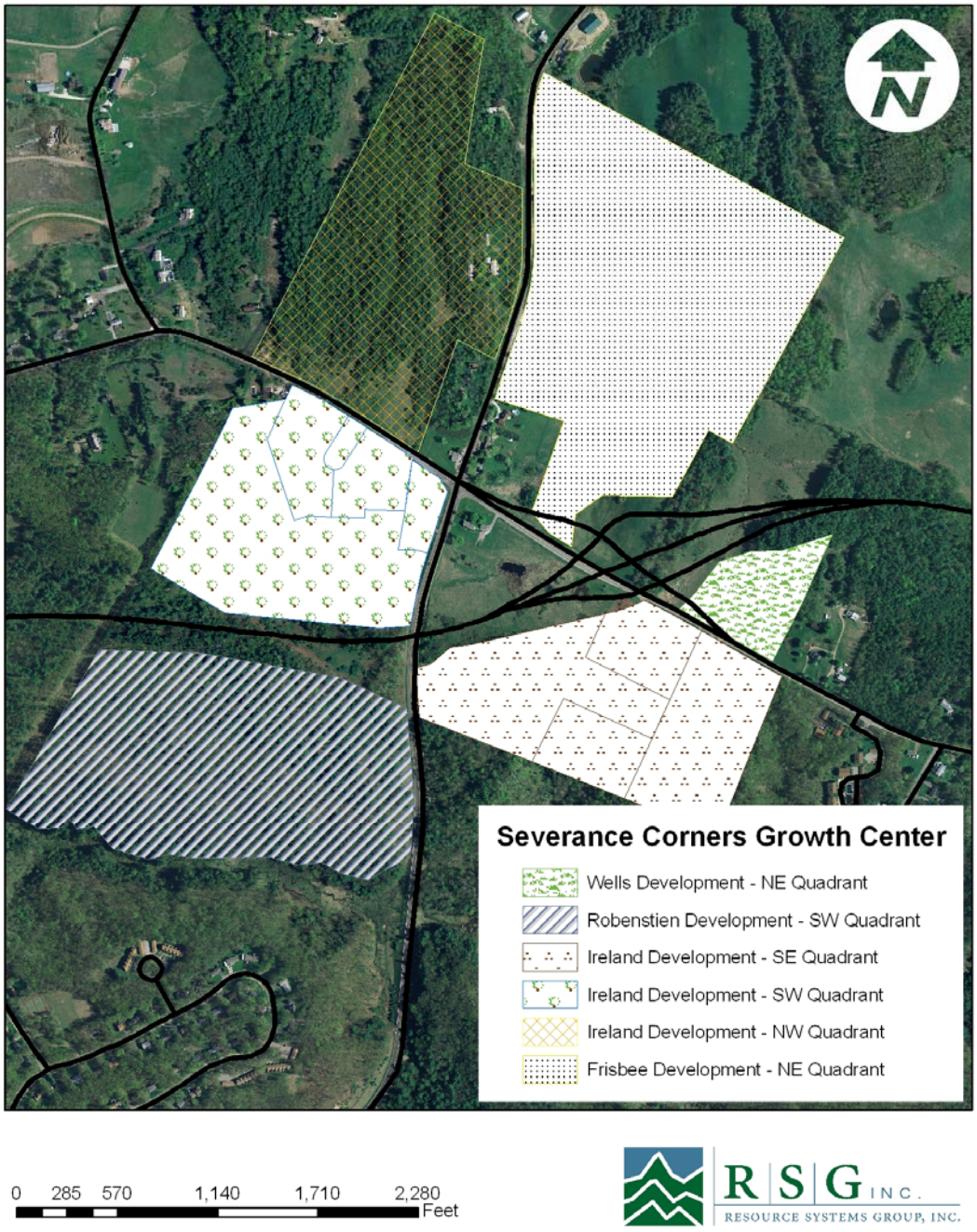


Figure 13 and Figure 14 show the cumulative traffic volumes of the future 2017 background growth and the assumed development at Severance Corners.

Figure 13: 2017 AM Total Traffic Volumes (Background + Severance Corners Development)

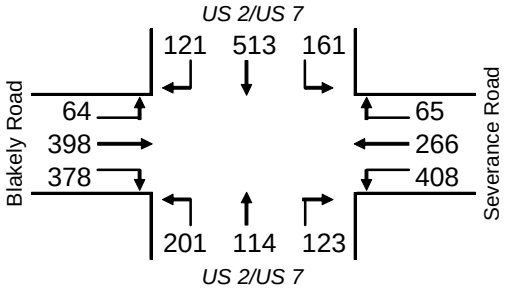
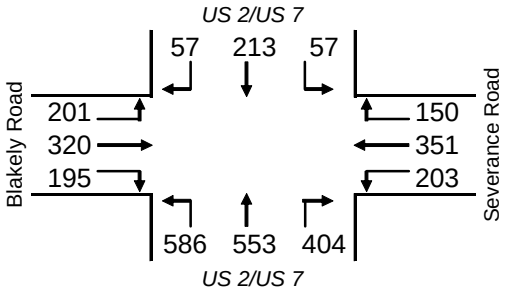


Figure 14: 2017 PM Total Traffic Volumes (Background + Severance Corners Development)



5.0 PLANNING YEAR 2017 TRAFFIC OPERATION

This section explains the methodology used to assess congestion and capacity by presenting the vehicle delay, level of service, and queuing results for the Severance Corners intersection.

5.1 LOS METHODOLOGY

Level-of-Service (LOS) is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream. The 2000 Highway Capacity Manual (HCM) defines six grades to describe the level of service at an intersection. Level-of-service is based on the average delay per vehicle.

Table 5 shows the various level-of-service grades, qualitative descriptions, and quantitative definitions for unsignalized, signalized, and roundabout intersections.

Table 5: LOS Criteria for Intersections

LOS	CHARACTERSTICS	SIGNALIZED DELAY (sec)	UNSIGNALIZED DELAY (sec)
A	Little or no delay	≤ 10.0	≤ 10.0
B	Short delays	10.1-20.0	10.1-15.0
C	Average delays	20.1-35.0	15.1-25.0
D	Long delays	35.1-55.0	25.1-35.0
E	Very long delays	55.1-80.0	35.1-50.0
F	Extreme delays	80.0<	50.1<

The VTrans policy on LOS[1] states that its highways will maintain a LOS C for the prescribed design period. The LOS C refers to the overall LOS for the facility as defined in the latest HCM. Reduced LOS criteria may be acceptable within densely settled areas or if negative impacts may arise when achieving LOS C.

The target intersection operation design of the Severance Corners intersection is LOS C for overall PM peak hour design. Specific movements may experience higher delays and decreased LOS, however, the target LOS during the analysis scenarios for overall operation is LOS C. In addition to Level of Service, volume to capacity (V/C) ratio, and vehicle queues were evaluated for each movement.

Synchro (v7), a traffic analysis software package from Trafficware, was used to quantify delay, level of service, and vehicle queues at the study intersections. The software uses procedures that are consistent with those specified in the 2000 Highway Capacity Manual. aaSidra was used to evaluate traffic operations for a roundabout design scenario at the intersection. SimTraffic was used in combination with Synchro to provide a comprehensive picture of vehicle operations at the Severance Corners intersection. The level of service summary tables display the HCM results from Synchro. The SimTraffic data was used to develop storage pocket lengths. Appendix B includes all SimTraffic data.

The analysis results present an in-depth picture of future operations at the intersection. It can be helpful to compare different analysis methodologies. Each method provides insight on how the queues interact with delay and affect vehicle flow through the intersection.

5.2 EXISTING 2007 LOS AND QUEUING RESULTS

Table 6 and Table 7 display the congestion and queuing analysis for the existing 2007 conditions during the AM and PM peak hours. Existing traffic signal timings were provided by VTrans and are used for the 2007 scenarios.

[1] VTrans Highway Design Level of Service Policy, 31 May 2007.

Table 6: 2007 AM Existing Conditions

US 2/7 - Severance/Blakely Roads	2007 AM Existing Conditions			
	LOS	Delay (sec)	V/C	Average Queue (feet)
Overall	**D**	**41**		
EB L (Blakely Road)	C	23	0.09	38
EB T (Blakely Road)	D	38	0.57	267
EB R (Blakely Road)	C	31	0.20	65
WB L (Severance Road)	C	34	0.70	238
WB T (Severance Road)	C	31	0.41	206
WB R (Severance Road)				
NB L (US 2/7)	D	46	0.50	99
NB T (US 2/7)	D	38	0.30	115
NB R (US 2/7)	D	38	0.05	41
SB L (US 2/7)	B	19	0.16	78
SB T (US 2/7)	E	66	0.96	551
SB R (US 2/7)				

Table 7: 2007 PM Existing Conditions

US 2/7 - Severance/Blakely Roads	2007 PM Existing Conditions			
	LOS	Delay (sec)	V/C	Average Queue (feet)
Overall	**C**	**26**		
EB L (Blakely Road)	C	25	0.36	68
EB T (Blakely Road)	C	26	0.44	150
EB R (Blakely Road)	C	22	0.11	43
WB L (Severance Road)	C	21	0.32	75
WB T (Severance Road)	C	33	0.77	309
WB R (Severance Road)				
NB L (US 2/7)	C	24	0.73	280
NB T (US 2/7)	C	28	0.78	424
NB R (US 2/7)	B	28	0.23	59
SB L (US 2/7)	D	35	0.16	23
SB T (US 2/7)	C	32	0.61	154
SB R (US 2/7)				

The existing 2007 conditions indicate the following:

- The AM peak hour is significantly more congested than the PM peak hour with long delays and queues on the westbound Severance Road and southbound US 2/7 approaches. The long westbound Severance Road queues for the left turning traffic block the westbound through traffic from proceeding through the intersection.

5.3 FUTURE 2017 TRAFFIC SIGNAL LOS AND QUEUING RESULTS

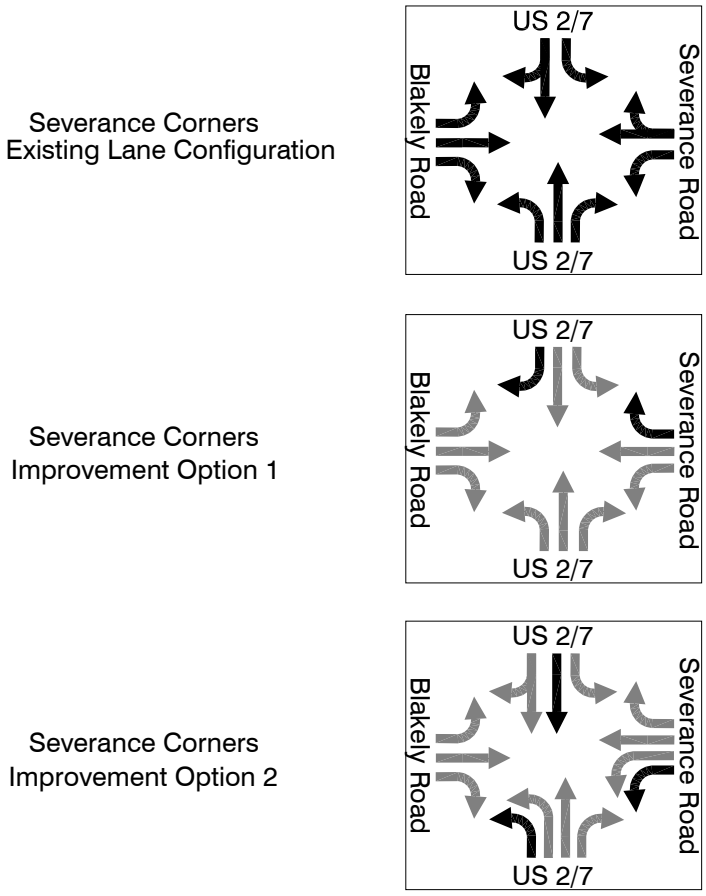
The future 2017 background traffic conditions and three improvement options were evaluated for congestion and queuing at the Severance Corners intersection. The 2017 background conditions provide an indication on how the intersection would operate if no development occurred in the Severance Corners area.

The three improvement scenarios include all assumed development at the Severance Corners area, using the volumes displayed in Figure 13 and Figure 14. All 2017 scenarios assume optimization of the traffic signal timing plans.

The three scenarios are the following:

- **2017 No Change:** Signal timing was optimized to account for the surrounding development, but no other changes were made.
- **2017 Improvement Option 1:** Signal timing was optimized and right-turn lanes were added to the westbound and southbound approaches.
- **2017 Improvement Option 2:** Signal timing was optimized and an additional left-turn lane on the westbound and northbound approaches, and an additional southbound through lane.

Figure 15: Intersection Lane Configuration Options



Improvement Option 2 design sketch is attached in Appendix C.

The capacity and congestion results for the 2017 AM and PM peak hours are shown in Table 8 and Table 9. The 2017 AM and PM peak hour capacity and congestion results for the two-lane roundabout analysis are displayed in Table 10.

2017 traffic signal congestion analysis indicates that:

- LOS, Delay, and Queuing indicate improvements are warranted whether or not any development occurs in the Severance Corners area, as shown in the 2017 background traffic scenario. The AM peak hour experiences significant delay and long queues on the westbound and southbound approaches.
- In the 2017 No Change Option (no capacity improvements with the additional Severance Corners development) the previously constrained movements fail. During the AM peak hour all four approaches have movements with LOS E or worse. The PM peak hour also experiences poor operation on the northbound and westbound approaches.

- Improvement Option 1 improves vehicle operation at the traffic signal during both periods, but would still experience significant delay and long queues during the AM peak hour on the westbound and southbound approaches.
- Improvement Option 2 improves vehicle operation at the traffic signal to acceptable levels for all movements and approaches.

The traffic signal alternatives were analyzed without accounting for pedestrian actuations. It is assumed that a traffic signal as large as that shown in Improvement Option 2, and perhaps in Option 1 as well, should have an exclusive pedestrian phase. The typical concurrent pedestrian phase would not be recommended based on the number of travel lanes and exclusive turn phases through the intersection.

An exclusive phase allows a longer time for pedestrians to cross without the potential conflict of turning vehicles. However, an exclusive pedestrian phase that provides enough time for the average person to cross 5 lanes of traffic would last at least 20 seconds or more. Depending on the amount of pedestrian activity (and the number of pedestrian actuations) occurring within the growth center, traffic signal delay would be higher than what is shown in Table 8 and

Table 9.

Table 8: LOS Results 2017 AM Peak Hours

	2017 Background Conditions (*No Severance Corners Development*)				2017 No Change (*Development but No Highway Improvements*)				2017 Improvement Option 1 (*Right-Turn Lanes added to Westbound and Southbound Approaches*)				2017 Improvement Option 2 (*Add left-turn lane on the westbound and northbound approaches, and add southbound through lane*)			
US 2/7 - Severance/Blakely Roads	LOS	Delay (sec)	V/C	Average Queue (feet)	LOS	Delay (sec)	V/C	Average Queue (feet)	LOS	Delay (sec)	V/C	Average Queue (feet)	LOS	Delay (sec)	V/C	Average Queue (feet)
Overall	**D**	**43**			**E**	**57**			**D**	**42**			**D**	**35**		
EB L (Blakely Road)	C	27	0.11	47	D	35	0.18	54	C	23	0.15	43	C	32	0.18	75
EB T (Blakely Road)	D	49	0.79	343	E	59	0.87	434	D	51	0.88	367	D	38	0.76	371
EB R (Blakely Road)	D	36	0.37	138	D	39	0.50	196	C	30	0.48	151	C	29	0.40	150
WB L (Severance Road)	D	47	0.83	369	E	76	0.97	448	E	62	0.96	358	D	36	0.58	196
WB T (Severance Road)	D	37	0.54	247	D	39	0.63	310	C	28	0.53	201	C	30	0.52	262
WB R (Severance Road)									C	26	0.04	30	C	28	0.04	36
NB L (US 2/7)	E	56	0.67	125	F	96	0.94	207	D	47	0.72	120	D	41	0.50	117
NB T (US 2/7)	D	46	0.48	136	D	50	0.52	139	D	36	0.45	108	D	40	0.45	139
NB R (US 2/7)	D	46	0.05	46	D	50	0.08	54	C	34	0.08	46	D	37	0.08	53
SB L (US 2/7)	B	18	0.16	87	C	20	0.21	112	B	16	0.23	90	C	33	0.40	177
SB T (US 2/7)	D	48	0.89	587	E	65	0.97	718	D	55	0.94	472	D	38	0.75	298
SB R (US 2/7)									C	24	0.08	40				

Table 9: LOS Results 2017 PM Peak Hours

	2017 Background Conditions (*No Severance Corners Development*)				2017 No Change (*Development but No Highway Improvements*)				2017 Improvement Option 1 (*Right-Turn Lanes added to Westbound and Southbound Approaches*)				2017 Improvement Option 2 (*Add left-turn lane on the westbound and northbound approaches, and add southbound through lane*)			
US 2/7 - Severance/Blakely Roads	LOS	Delay (sec)	V/C	Average Queue (feet)	LOS	Delay (sec)	V/C	Average Queue (feet)	LOS	Delay (sec)	V/C	Average Queue (feet)	LOS	Delay (sec)	V/C	Average Queue (feet)
Overall	**C**	**30**			**D**	**44**			**C**	**32**			**C**	**31**		
EB L (Blakely Road)	C	34	0.45	89	D	43	0.71	130	D	40	0.72	173	D	46	0.76	222
EB T (Blakely Road)	C	35	0.62	208	D	37	0.74	245	D	41	0.75	271	C	29	0.64	241
EB R (Blakely Road)	C	29	0.40	53	C	27	0.12	49	C	29	0.12	52	C	23	0.12	48
WB L (Severance Road)	C	22	0.28	100	C	26	0.44	118	C	35	0.61	175	C	35	0.49	90
WB T (Severance Road)	D	38	0.78	331	E	60	0.95	465	D	44	0.80	300	D	38	0.78	282
WB R (Severance Road)									C	31	0.20	75	C	27	0.18	65
NB L (US 2/7)	C	26	0.79	290	E	74	1.04	467	C	29	0.86	478	C	33	0.74	214
NB T (US 2/7)	C	29	0.74	449	D	36	0.84	475	C	26	0.71	436	C	31	0.82	462
NB R (US 2/7)	B	29	0.45	59	C	36	0.25	60	B	18	0.25	58	B	19	0.25	59
SB L (US 2/7)	D	40	0.13	26	D	40	0.26	37	C	29	0.22	38	C	25	0.27	38
SB T (US 2/7)	D	36	0.63	201	D	38	0.71	211	D	43	0.69	242	C	30	0.37	101
SB R (US 2/7)									C	35	0.04	36				

5.4 FUTURE 2017 ROUNDABOUT LOS AND QUEUING RESULTS

A two-lane roundabout was evaluated at the Severance Corners area for vehicle delay and queuing. The traffic volumes at the Severance Corners intersection exceed the typical capacity of a one-lane roundabout, somewhere in the 1,500-2,200 vehicles per hour range depending on the proportion of left-turns.

Table 10: 2017 AM & PM Two-Lane Roundabout Operation

US 2/7 - Severance/Blakely Roads	2017 AM				2017 PM			
	LOS	Delay (sec)	V/C	Average Queue (feet)	LOS	Delay (sec)	V/C	Average Queue (feet)
Overall	**LOS B**	**13**	**0.54**		**LOS B**	**13**	**0.83**	
Eastbound (Blakely Road)	LOS B	17	0.54	109	LOS A	8	0.33	51
Westbound (Severance Road)	LOS B	12	0.43	72	LOS B	15	0.59	103
Northbound (US 2/7)	LOS B	11	0.27	35	LOS B	14	0.83	304
Southbound (US 2/7)	LOS B	10	0.49	84	LOS B	12	0.26	42

The 2017 roundabout congestion analysis indicates that:

- A 2-lane roundabout would operate within acceptable limits with low levels of delay and short queue lengths during both the AM and the PM peak hours.

The roundabout analysis does not take into account the effect that pedestrians would have on vehicle delay and queues. It can be assumed that a pedestrian crossing each approach would stop only the oncoming vehicles, which then have only a marginal effect on overall roundabout operation.

For crossing pedestrians, a two-lane roundabout acts much like a mid-block unsignalized intersection. The pedestrians must wait for vehicles to stop to let them cross. Currently there are signals being tested nationally that could be installed for pedestrian actuation that require vehicles to stop and let the pedestrians cross.

Detailed LOS worksheets are included in Appendix B.

6.0 PHASING PLAN

The improvements at the Severance Corners intersection can be phased to expand signal capacity as needed. This approach will reduce unneeded paved areas, maximize return on saved capital, and reduce the possibility of over-building the intersection if traffic growth rates are slower than projected. It is expected that the full plan will result in the improvements shown in Improvement Option 2.

As with any phased development of a potential full-build out, certain elements such as sidewalks and shared-use paths should be built in their final location to reduce rebuilding infrastructure.

The phased approach is only applicable to a traffic signal alternative. A two-lane roundabout is required in every analysis scenario.

6.1 PHASE 1

The first expansion of the intersection is necessary now under existing 2007 conditions. The need is most acute during the AM Peak. The westbound left-turn movement from Severance Road onto US 2/7 is significant and if it remains one-lane it requires a significant amount of green time. This expansion should be pursued at the Town's earliest opportunity.

Phase 1 includes:

- Create an additional westbound left-turn lane along Severance Road;
- Widen the westbound approach along Severance Road to accommodate the lane shift; and
- Widen Southbound US 2/7 south of the intersection. The widening should occur for a distance long enough to provide sufficient room for vehicles to merge together into one-lane of traffic. The receiving lane should be designed with the new intersection for the Severance Corners Village in mind.

The figures below show the additional westbound left-turn lane to the intersection lane configuration and the schematic of the areas affected.

Severance Corners
Phase 1

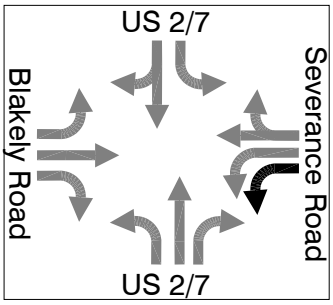
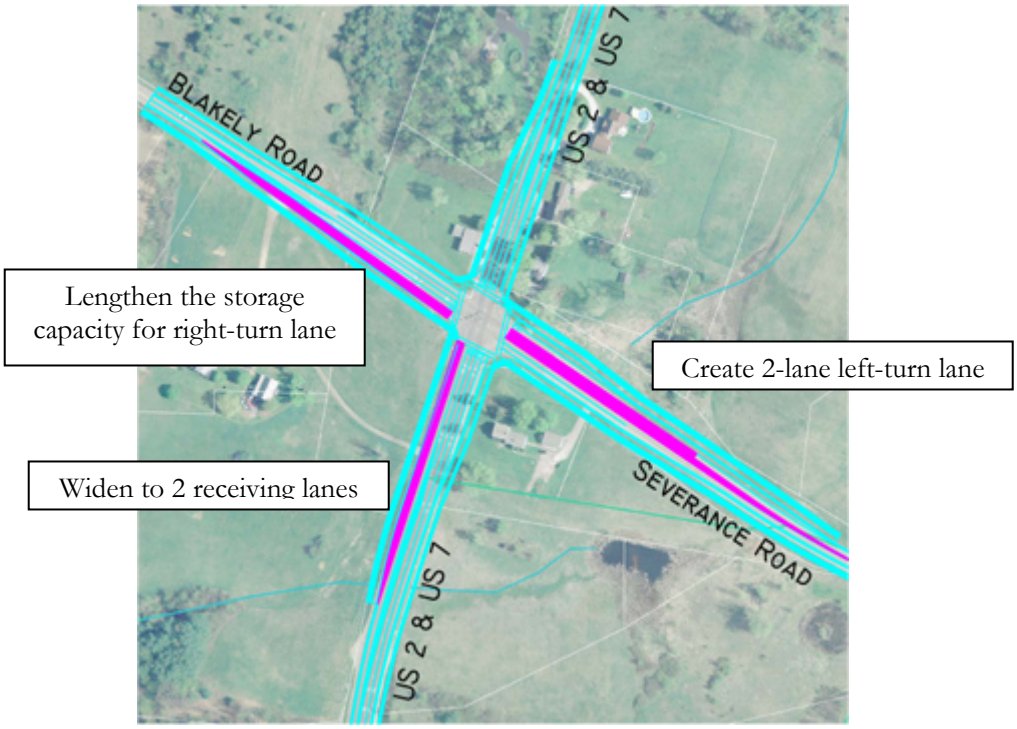


Figure 16: Phase 1 Area (Schematic)



6.2 PHASE 2

Phase 2 will complete the build-out of the intersection. Based on the 1% background growth rate derived in Chapter 4.0 and an estimate of Severance Corners development, phase 2 should be completed by 2014.

Phase 2 includes:

- Create an additional northbound left-turn lane along US 2/7;
- Widen westbound Blakely Road west of the intersection. The widening should occur for a distance long enough to provide sufficient room for vehicles to merge together into one-lane of traffic;
- Create a new southbound through lane along US 2/7; and
- Create an exclusive westbound right-turn lane on Severance Road.

The figures below show the intersection lane configuration and the schematic of the areas affected.

Severance Corners
Phase 2

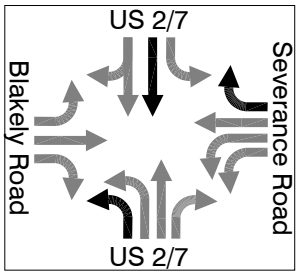
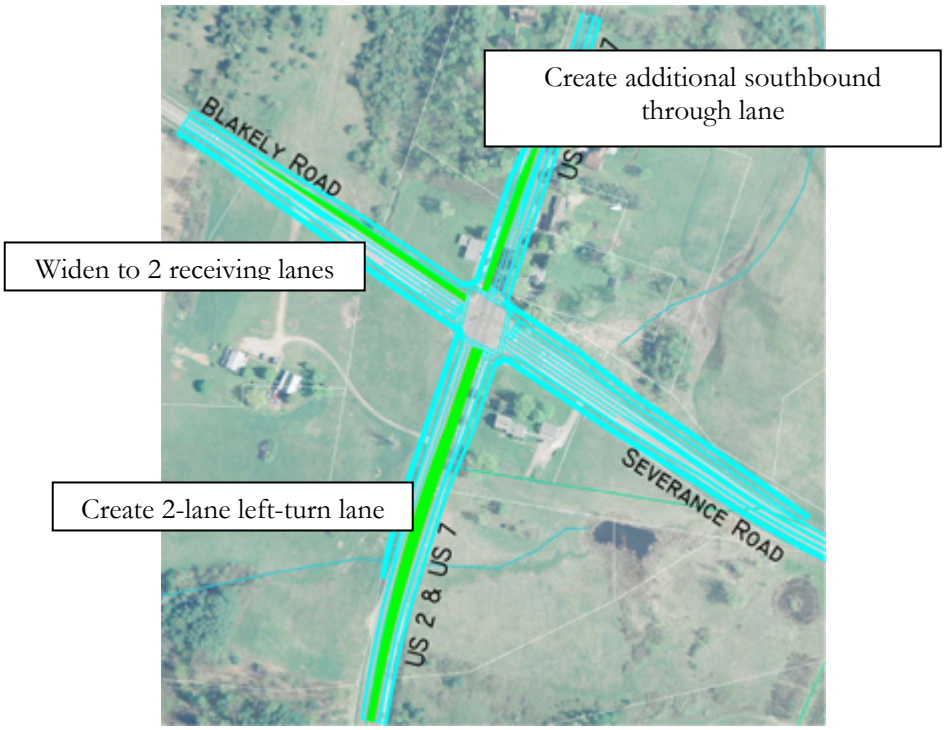


Figure 17: Phase 2 Area (Schematic)



7.0 COST ESTIMATES OF IMPROVEMENTS

The costs of the recommended improvements at the Severance Corners intersection are shown below in Table 11. These costs are shown in current year 2007 dollars and do not include estimated right-of-way costs or the bicycle and pedestrian improvements planned as part of the CCMPO's Bicycle and Pedestrian Circulation System Plan.

Table 11: Severance Corners Improvement Costs

Traffic Signal Improvement Option 2		
Materials, Drainage & Utilities	$	760,000
Traffic Control	$	80,000
Mobilization	$	60,000
Preliminary and Construction Engineering	$	170,000
Contingency	$	40,000
Total:	**$**	**1,110,000**
Roundabout Improvement Option		
Materials, Drainage & Utilities	$	660,000
Traffic Control	$	70,000
Mobilization	$	50,000
Preliminary and Construction Engineering	$	150,000
Contingency	$	30,000
Total:	**$**	**960,000**

Table 12 shows the estimated phased cost of implementing the traffic signal improvements. It is estimated to cost approximately $100,000 more in 2007 dollars to phase the improvements. This is primarily associated with a relatively fixed cost of traffic control and mobilization at the busy intersection.

Table 12: Cost of Implementation of Phased Improvements

Traffic Signal Improvement Option - Phase 1		
Materials, Drainage & Utilities	$	530,000
Traffic Control	$	80,000
Mobilization	$	40,000
Preliminary and Construction Engineering	$	120,000
Contingency	$	30,000
Sub-Total:	**$**	**800,000**
Traffic Signal Improvement Option - Phase 2		
Materials, Drainage & Utilities	$	260,000
Traffic Control	$	80,000
Mobilization	$	20,000
Preliminary and Construction Engineering	$	60,000
Contingency	$	10,000
Sub-Total:	**$**	**430,000**
Grand Total:	**$**	**1,230,000**

8.0 SUMMARY

The purpose of this project is to provide a comprehensive traffic assessment of the Severance Corners intersection for the future 2017 analysis year. This report describes the existing conditions in

the study area and assesses the future performance of the intersection. The future 2017 traffic conditions were analyzed using information obtained from the previously completed traffic impact studies for development occurring within the area and from available regional traffic data.

Key findings of each section are summarized below:

8.1 TRAVEL DEMAND

- The recent trend in the study area indicates that traffic volume growth has slowed since 2000 to approximately 1% per year from a higher rate of around 1.4% throughout the 1980's and 1990's.
- Assuming a 1% annual growth rate, background traffic through the intersection represents about 36% of the total change from 2007 to 2017. The development occurring at the Severance Corners growth center accounts for the remaining 64%.

8.2 PLANNING YEAR 2017 TRAFFIC OPERATION

- The congestion analysis indicates that:
  - In 2007 during the AM peak hour the westbound Severance Road and southbound US 2/7 approaches experience high levels of delay and significant queuing.
  - Improvements are necessary by 2017 to accommodate background growth only.
  - Two-lane left-turn lanes are recommended on the northbound US 2/7 and westbound Severance Road approaches requiring widening of the mainlines to receive two lanes of traffic.
  - The two-lane roundabout would operate well under all analysis scenarios.
  - The effects of pedestrians at the intersection have not been quantified. It can be assumed that they will increase delay for vehicles for all design alternatives.

8.3 PHASING PLAN

- The traffic signal improvements suggested during the congestion and capacity analysis can be phased to match growth in traffic volumes.
- Phase 1 includes widening the westbound left-turn on Severance Road to two turning lanes.
- Phase 2 would expand the northbound left-turn on US 2/7 to two lanes and expand the southbound through lanes to two lanes. Phase 2 results in the full build out of the intersection.

8.4 COST ESTIMATES OF IMPROVEMENTS

- The estimated cost of the traffic signal improvement option 2 is $1.1 Million. The estimated cost of the two-lane roundabout is $960,000.

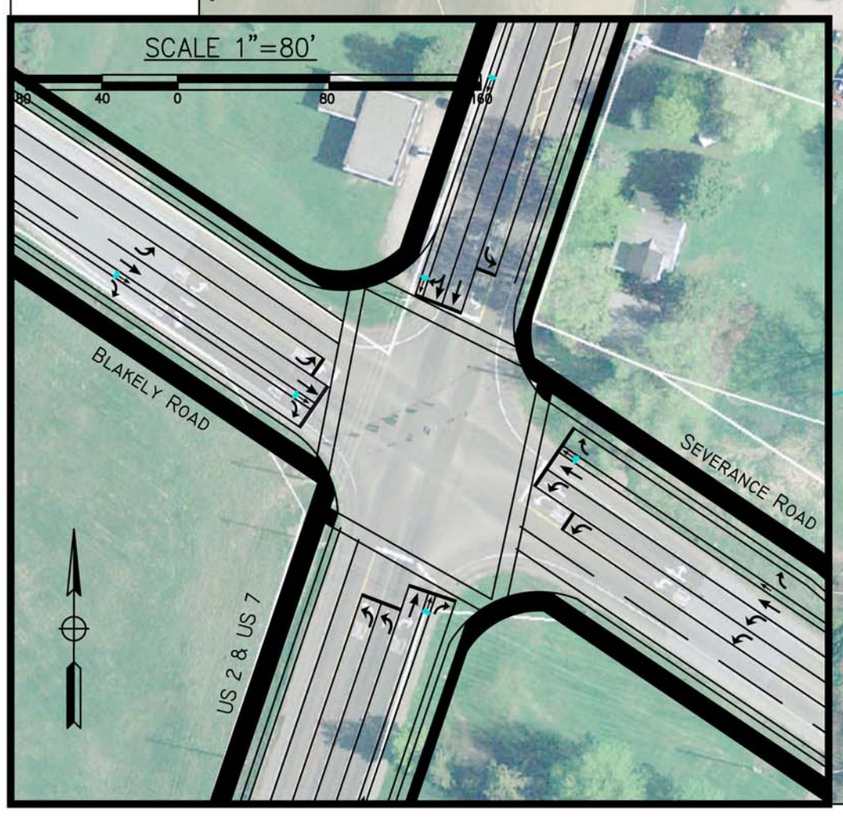
- The phased approach to the intersection improvements is estimated to cost approximately $100,000 to account for traffic control and mobilization.
- The cost estimates are in current year 2007 dollars. They do not include right-of-way estimates or the costs of the pedestrian and bicycle infrastructure shown in the CCMPO's Severance Corners Bicycle and Pedestrian Circulation System Plan.

DRAFT
FOR DISCUSSION PURPOSES ONLY

REV. NO.	DATE	DESCRIPTION	BY	CHECKED BY
	5/24/2007	RESVISED TO PLACE A 5' GREEN BELT		

Sidewalks and Shared-Use paths are based on the CCMPO Severance Corners Bicycle and Pedestrian Circulation System Plan

Drainage is not included in any of the assumptions for greenbelt widths or additional ROW requirements.



BLAKELY ROAD

US 2 & US 7

SEVERANCE ROAD

US 2 & US 7

SCALE 1"=200'

200 100 0 200 400

SEVERANCE CORNERS PLAN
SIGNAL ALTERNATIVE: IMPROVEMENT OPTION 2

RSG INC. RESOURCE SYSTEMS GROUP, INC.

SCALE:	AS NOTED
DESIGNED BY:	J. SLASON
DRAWN BY:	J. SLASON
CHECKED BY:	
DATE:	5/1/07
PROJ. NO.:	07067

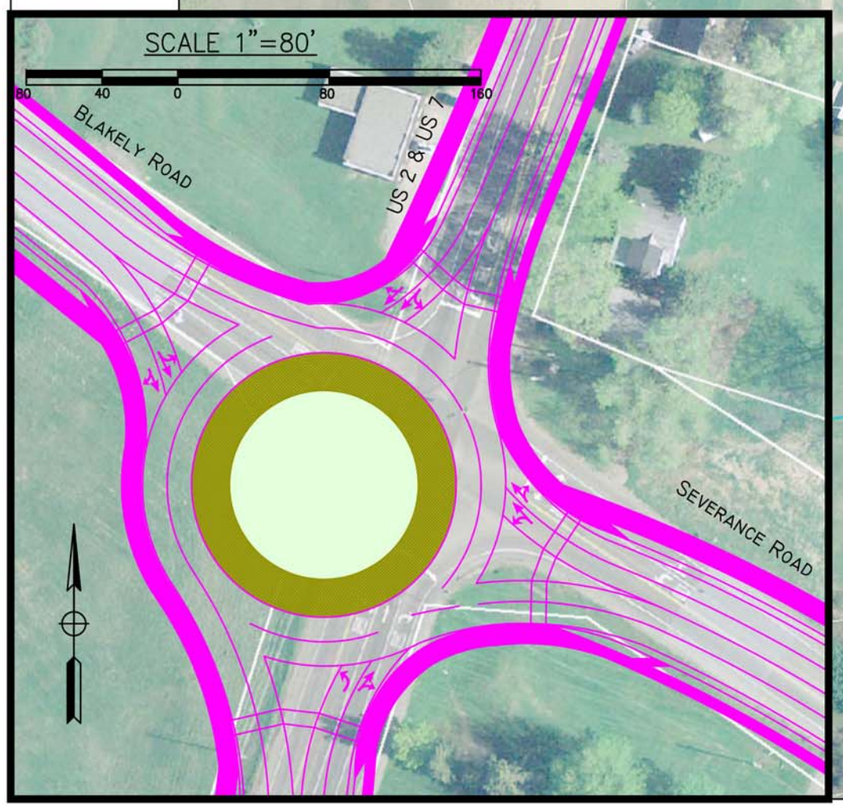
SHEET 1 OF 2

DRAFT
FOR DISCUSSION
PURPOSES ONLY

Drainage is not included in any of the assumptions for greenbelt widths or additional ROW requirements.

Sidewalks and Shared-Use paths are based on the CCMPO Severance Corners Bicycle and Pedestrian Circulation System Plan

REV. NO.	DATE	DESCRIPTION	BY	CHECKED BY



SCALE 1"=200'
200 100 0 200 400

SEVERANCE CORNERS PLAN
ROUNDABOUT ALTERNATIVE

RSG INC.
RESOURCE SYSTEMS GROUP, INC.

SCALE:	AS NOTED
DESIGNED BY:	J. SLASON
DRAWN BY:	J. SLASON
CHECKED BY:	MS
DATE:	5/24/07
PROJ. NO.:	07067

SHEET 2 OF 2